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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/800,575

03/15/2004

Jeremy H. Burroughes

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1720

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7590

06/29/2004

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EXAMINER

KRISHNAN, SUMATI

ART UNIT

PAPER NUMBER

2879

DATE MAILED: 06/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/800,575

Applicant(s)

BURROUGHS ET AL.

Examiner

Sumati Krishnan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-61 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-61 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date: ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>0304</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION***Claim Rejections - 35 USC § 103***

1. Claims 1-12, 14-15, 17-18, 21-31, 33-34, 36-38, 41-53, 55-56, 58, and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al (US 6137223) in view of Ueda (US 6395409).

Regarding claims 1-3, 5-6, 10, 22-24, 29, 36, 42-44, 46-47, 51 and 58, Hung discloses an opto-electrical device comprising an anode electrode (504), a transparent cathode electrode (510, 532, 530), and an opto-electrically active region (520) capable of generating an electric field in response to light located between the electrodes. The cathode electrode includes a second layer (532) comprising a material having a work function below 3.5 eV (see col. 10 lines 13-15 which states the layer comprising a material having a work function lower than 4.0 eV), and a third layer (510) spaced from the opto-electrically active region by the first and second layers having a work function greater than 3.5 eV (col. 10 lines 24-25, stating cathode has work function greater than 4.0 eV). Hung also discloses the cathode comprising a first layer 530, comprising a material selected from a group 1, group 2, or transition metal (see col. 10 lines 47-51 which explains that materials from groups 1a and 2a existing in layer 532 diffuse into layer 530). Hung does not specifically disclose that the material is a **compound** of the group 1, group 2, or transition metal. However, Ueda discloses that when the electron-injection layer (first layer, or material in layer 530) is formed of “a composite layer comprising a metal oxide, a metal halide and a different material therefrom” electron-injection properties are improved. Ueda lists preferred materials in col. 4 lines 47-55,

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including group 1 metals, group 2 metals, and transition metals including halides, fluorides and materials selected from the group listed in claims 10, 29 and 51. Ueda teaches that the flow of electrons is made smooth under a high electrical field, so that light luminescence starting voltage necessary for an organic electro-luminescent element to emit light may be low and that stable light emission may be achieved over a long period of time. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the composition for the electron injection layer, (532), disclosed by Ueda for the advantages listed above.

Regarding claims 4, 25 and 45, Hung discloses lithium and calcium as one of the materials in the first layer, see col. 10 lines 50-51.

Regarding claims 7-9,26-28, and 48-50, Hung teaches that both layers 532 and 530 qualify as the 'first layer' as well as the 'second layer' as claimed in claim 1. This is because Hung teaches that some of material present in layer 532 (selected from groups 1a and 2a) diffuses to layer 530, forming the electron-injecting interface 540 (which exists in layer 530). In addition, layer 530 is adjacent layer 520 (opto-electrically active layer.)

Regarding claims 11,12,14, 30,31,33,52,53, and 55, Hung discloses that layer 530 is from 5-10 nm, layer 532 is from 0.5-2.0 nm, and in Example A, Hung discloses that the cathode (third layer) is 200 nm.

Regarding claims 15,34 and 56, the claim limitation that the material has a particular electrical conductivity is a characteristic of the material claimed. Since any claims directed toward the specific material denoted for use in these layers have been rejected in view of prior art, any limitation directed toward the characteristic that these materials possess would be unpatentable as well. Therefore, claim language directed

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toward an intrinsic characteristic of the structure claimed is not afforded patentable weight.

Regarding claims 17-18 and 37-38, Hung's opto-electrically active layer 520 is organic and light emissive.

Regarding claim 21, 41 and 61, Hung discloses an electron injection layer 540, which qualifies as a charge transport layer located between the light emissive organic material and an electrode.

Claims 16, 35 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al (US 6137223) in view of Tang (US 4356429). It is well known in the art to provide a cathode (said material having a work function above 3.5 eV) using either aluminum, gold or indium tin-oxide, as evidenced by Tang, see col. 3-4, lines 65-70, 1-3. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used any of the claimed materials as the cathode of Hung since such materials possess the necessary work function and in particular it would have been obvious to use aluminum as the cathode of Hung since it is widely available and inexpensive thus contributing to manufacturing ease.

Claims 19-20, 39-40, and 59-60 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al (US 6137223) in view of Cao (US 6452218). Hung discloses the opto-electrically element as claimed in claim 1, but does not disclose a conjugated polymer as the opto-electrically active region. Cao, however, discloses the use of a conjugated polymer material in the organic layer of an LED, teaching that this type of polymer LED offers high brightness, high efficiency and an extended operating

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life. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use such a polymer as opto-electric element of Hung in order to achieve high brightness, high efficiency and an extended operating life.

Allowable Subject Matter

Claims 13,32 and 54 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record neither shows nor suggests the compound in the first layer which has a work function below 3.5 eV, having a higher work function than the material having a work function below 3.5 eV of which the second layer is comprised.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sumati Krishnan whose telephone number is 571-272-2372. The examiner can normally be reached on 9:00 am - 5:30 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel can be reached on 571-272-2457. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


SK

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